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The British Airship Mission, 1927

It is probably unique in the records of the British Meteorological Office that an opportunity should arise for the deputation of one of its members as a delegate on an Imperial Mission. Such an opportunity was furnished, however, when in May, 1927, the Airship Mission set sail for a tour of the Dominions for the purpose of advising as to the siting of Airship bases and laying down Airship routes as an outcome of the Imperial Conference which met in London in the autumn of 1926. The members of the mission were Group Captain P. F. M. Fellowes, D.S.O., A.D.C., R.A.F. (Director of Airship Development), Mr. M. A. Giblett (Superintendent, Airship Services Division, Meteorological Office), and Flight Lieutenant S. Nixon, O.B.E., R.A.F., of the Royal Airship Works.

As it was impossible in the space of time available for the single mission to cover the whole extent of the Empire on the routes which it is visualised that airships will eventually cover, if regular transport services are established, a second mission consisting of Major G. H. Scott, C.B.E., of the Royal Airship Works, and Mr. A. R. Gibbs, of the Works and Buildings Department of the Air Ministry, visited Canada, and working in close liaison with the Meteorological Offices in London and Toronto, supplied that Dominion with an outline of the essential meteorological requirements. In order further to lighten the onerous work of the main mission, Flight Lieutenant Nixon anticipated their departure and visited the British Colonies on the east and west coasts of Africa and in a similar manner took account of meteorological factors in his recommendations as to possible sites for intermediate bases.

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The original itinerary of the main mission included primarily South Africa and Australia, but on the urgent request of the New Zealand Government it was extended to embrace that dominion. St. Helena and Ceylon were also visited. Thus during the year a meteorological survey from the airship standpoint was made of almost the entire Empire.

The main results of the missions, as given in an article published in the *Times* of January 7th, may be summarised as follows:—

A skeleton has now been prepared of main and intermediate bases on what are likely to be the chief commercial airship routes of the future.

Each Dominion has now had placed at its disposal a full statement of the prime necessities for the operation of these routes.

A choice of sites for bases has been tabulated in Canada, South Africa, Australia (including Tasmania), New Zealand, Ceylon and India, and certain intermediate bases have been prospected on the east and west coasts of Africa and in the Cocos Islands.

The existing meteorological information required along the proposed routes has been added to where possible during the survey, and the Dominion authorities have been made acquainted in detail and by personal discussion with the essential weather and wireless services needed before airships can hope to operate on long-distance routes.

At each point visited it was found that there was a vivid interest in the prospect of Airship communications, especially among the business communities, and it is increasingly being realised how important to such communications are the meteorological factors. It is understood that practically throughout the Empire an early commencement of meteorological work to meet the special requirements outlined by the missions is to be made. In Australia the members of the mission, at the request of Mr. Bruce, made numerous public statements to chambers of commerce and other bodies on the present position of airships and the prime necessities for their efficient operation as regards ground organisation. In New Zealand the interest was such that the Premier convened a joint session of the Houses of Parliament, and Group Captain Fellowes addressed the assembly for nearly an hour. For another hour Mr. Giblett and Flight Lieutenant Nixon answered questions on various aspects of the problem, and at the request of the Premier the former gave a short address on the meteorological problems involved.

During the course of the tour the opportunity of gaining first-hand knowledge by both aeroplane and motor car of the topographical features in the vicinity of prospective bases was invaluable to the meteorological member of the mission, as it enabled him to form an opinion of the meteorological effect of such features that no written records could convey.

In addition to the more tangible results of this mission, it is not to be overlooked that it has established a most important liaison between the British Meteorological Office and those engaged in the practice of meteorology throughout the Empire, a liaison which, as aviation spreads across the face of the globe, cannot fail to grow closer.

During the return journey the opportunity was taken of visiting India and Egypt, where the organisation for the England-Egypt-India route already initiated was reviewed and the discussion of details carried a stage further. In this, assistance was rendered by the presence in Egypt of the Superintendent, Meteorological Office, Malta, and the Meteorological Officer, Iraq, so that they were able to be consulted as well as the Meteorological authorities in Egypt.

The mission returned to England in December, 1927, having spent seven months on its Empire Survey.

The Effects of Height and Situation on Screen Temperatures

Meteorologists are generally familiar with the difficulty of securing observations of air temperature which shall be properly representative of the locality in which they are taken and comparable with observations from other places and countries. Accurate instruments are now readily obtained and the Stevenson screen has been proved reasonably satisfactory for screening the thermometers from radiation both solar and terestrial. The remaining condition necessary for comparable temperatures is standardisation of the site in which the screen is placed. This is secured with sufficient accuracy for practical purposes if a plot of ground covered by turf for an area of about 20 feet by 30 feet is provided in an unobstructed situation. Local exigencies occasionally necessitate the erection of a screen in an unorthodox situation and at a height differing from the standard height of 4 feet and it is therefore a matter of interest to know what sort of conditions may be anticipated owing to the unorthodox exposure of the screen. Naturally it is impracticable to deduce accurately comparable temperatures from the records so obtained but it is possible to obtain an approximate idea of the more important effects.

The differences arise in two ways:—

(1) Owing to the difference from the standard height;

(2) Owing to the difference between the nature of the surface of the ground or roof on which the screen is erected and the standard surface.

The general effect of the difference in height is to produce higher temperatures at night and lower temperatures in the middle of sunny days at the greater height. The effect of the difference of

surface from the standard surface is in general to produce lower temperatures at night and higher temperatures in the middle of sunny days. Usually the magnitude of the differences is greatest in calm weather.

Some idea of the magnitude of the difference due to height may be obtained from some observations made at Kew Observatory in screens placed at 17 feet and 4 feet respectively above a level grass plot. In winter the minimum temperature at 17 feet was, on the average, about 1° F. higher than the minimum temperature at 4 feet and practically the same in summer. The maximum temperature, on the other hand was less than ½° lower in winter at 17 feet than at 4 feet, whereas in summer it was more than 1° F. lower. The high screen at Kew Observatory was placed on an open stand, so that the whole difference arose from the difference of height.

In some observations recently made at Pieta in Malta the high screen was placed on the flat roof of the building and the readings from it compared with the readings from a screen in a garden adjoining. These observations were made simultaneously with the regular observations on the roof of the University at Valletta. It was indeed the differences between the readings on the roof of the University and in the garden at Pieta which instigated the comparisons. The height of the roof at Pieta above the garden is approximately 28 feet, the garden itself being 90 feet above mean sea level. There is a row of houses on the south-west side of the garden: they are 28 feet high and 40 feet from the thermometer screen. The University observatory is distant from Pieta about 2,000 yards. The height of the roof of the observatory above the ground in its neighbourhood is approximately 71 feet, and above sea level 200 feet.

If the three sites are denoted by :—

P.R. Pieta Roof; P.G. Pieta Garden; and U. University, the relations deduced from the observations may be briefly expressed as follows, where > means "is greater than";

	7h.	13h.	18h.
Summer	P.G.>P.R.>U.	P.G.>P.R.>U.	P.G.=P.R.=U.
Winter	U.>P.R.>P.G.	U.=P.R.>P.G.	U.>P.R. P.G.

It will be noticed that in winter the relations at 7h., 13h. and 18h. are the reverse of the relations in summer. (Times are G.M.T.)

For the maximum temperature :—

P.G.>P.R.>U. in summer
and P.R.>P.G.>U. in winter.

while for the minimum temperature :—

U.>P.R.>P.G. all the year round.

This indicates that the effect of the surface on the minimum temperature is outweighed by the difference in height all the year

round. The effect of the surface of the roof on the maximum temperature is, on the other hand, greater in the winter months and less in the summer months than the effect of the difference of height of 28 feet at Pieta. In winter the readings at 7h. correspond roughly with night temperatures, *i.e.*, with stratified lower layers, the coldest air being near the ground, and the same is true of the observations at 18h. In summer on the other hand the observations at 7h. correspond with the turbulent atmosphere of the daytime in which temperature diminishes from the ground upwards.

In both seasons the effect of the difference of height outweighs any effect arising from the difference in surface beneath the screens. On calm days in summer the temperature in the garden probably rises in the morning considerably faster than it would in an open situation, partly due to "pocketing" of the air in the garden and partly to warming by direct or reflected radiation from the wall of the house. A rapid rise between 7 a.m. and 8 a.m. local time is very noticeable on the thermograms.

The observations at 13h. in winter are at first sight more difficult of explanation. One would have anticipated that the effect of difference of height would have preponderated at this hour of observation both in the winter and in summer: it appears however that in winter the greater part of the garden at Pieta is in the shadow of the house by noon and remains in shadow throughout the rest of the day; the ground in the garden remains relatively cold and on calm days the air in the garden also remains cold: in fact the thermograms show that by 13h. the temperature is falling.

The result of these observations as far as they go, indicates that the objection to a roof exposure is due more to its elevated position than to the nature of the surface of the roof so long as the roof is an open one.

Another result of the comparisons of temperatures on the roof and in the garden at Pieta is that the diurnal ranges in the garden will normally be appreciably in excess of those on the roof, while the mean temperatures deduced from the observations of maximum and minimum temperature on the roof and in the garden will be in close agreement. The following figures of mean diurnal range illustrate this point very well. (The figures for the University are also given but in connexion with these some allowance must be made for the difference of situation which is (*a*) relatively more maritime than the situation at Pieta: (*b*) in Valletta, whose congested roofs form almost a new ground level). At Pieta there is a katabatic wind from WSW on clear nights.*

* See *London, Meteor. Office, Geophys. Memoir No.* 37, *p.* 8.

Mean Diurnal Ranges.

	University.	Pieta Roof.	Pieta Garden.
1926.			
May	9.5° F.	12.4° F.	14.0° F.
June	11.1	15.3	16.7
July	11.0	14.0	14.8
August ...	10.1	15.2	17.6
September ...	9.5	13.8	15.8
October ...	9.0	13.8	15.3
November ...	6.7	9.6	10.4
December ...	6.2	9.3	10.0
1927.			
January ...	6.0	9.4	10.1
February ...	8.4	11.6	12.7
March ...	9.0	12.1	13.3
April	8.5	11.7	12.8
May	9.6	12.5	14.0
Mean	8.8	12.4	13.7

Mean of Maximum and Minimum Temperatures.

	University.	Pieta Roof.	Pieta Garden.
1926.			
May	65.3° F.	65.6° F.	66.0° F.
June	70.7	71.4	71.7
July	74.8	75.1	75.5
August ...	75.7	75.8	75.8
September ...	76.7	76.7	76.8
October ...	72.6	72.3	72.1
November ...	68.7	68.7	68.4
December ...	57.8	57.2	56.9
1927.			
January ...	55.2	54.7	54.0
February ...	54.1	53.6	52.6
March ...	58.2	58.2	58.0
April	60.3	60.3	60.3
May	67.3	68.3	68.5
Mean	66.0	66.0	65.9

It is to be noted that the summer of 1926 was exceptionally windy and cool in Malta and the summer differences are probably less marked than they would be on the average.

Royal Meteorological Society

At the meeting of the Royal Meteorological Society, held on Wednesday, May 16th, the following three memoirs were discussed :—

1. "On periodicity and its existence in European weather," by Sir Gilbert T. Walker, F.R.S. (Memoir, Vol. I, no. 9.)
2. "Harmonic analysis and the interpretation of periodogram investigations," by D. Brunt. (Memoir, Vol. II, no. 15.)
3. "Periodicities in Nile floods," by C. E. P. Brooks. (Memoir, Vol. II, no. 12.)

In the first of these three papers, Sir Gilbert Walker emphasises the importance of considering the distribution of amplitudes which might be derived from a chance distribution of numbers, in any attempt at interpreting the results of periodogram investigations. An estimate is given of the probable greatest amplitude in the analysis of a series of figures distributed according to chance, and the result is compared with the computations of periodicities in European weather by Brunt. A later section of the paper indicates the number of significant figures which need be retained in harmonic analysis, it being usually sufficient to use group intervals equal to about one-third of the standard deviation.

The second paper gives a general discussion of the whole question of periodogram analyses. A new derivation is given of Schuster's formula for the distribution of the amplitude of a Fourier series representing a random distribution of observations. A formula is given by means of which the standard deviation can be corrected for the effect of one or more harmonic terms, and it is shown that this formula can be used to determine what fraction of the variability of the original observations is due to harmonic variations. It is suggested that the distribution of the computed amplitudes should be directly compared with the distribution corresponding to Schuster's formula. These methods are applied to twelve series of observations, and it is shown that whereas a number of periodicities in temperature records appear to be real, they only account for a small fraction, about one-seventh, of the variations of the original observations. Pressure and rainfall appear to show no important permanent periodicities.

The third paper is an analysis of data for the Nile floods from A.D. 641 to 1451. Periods with appreciable amplitudes are found between 1.91 years and 76.8 years, most of the 19 periods found being multiples or submultiples of 22.12 years. The surprising feature of Brooks' results is a fairly regular oscillation in the lengths of the periods found, the oscillation in each case having a period of about 500 years.

In the course of the discussion on the first two papers it was

emphasised that whereas it would have been reasonable to expect the 11-year sunspot cycle to show up in temperatures, yet only one of six series of temperature records actually showed an 11-year cycle. On the other hand, these records showed periods of curious lengths, such as 13, 29, 37, 42 months, &c., having lengths which appear to correspond to no known physical oscillation in the atmosphere or elsewhere. The existence of the same curious periods with substantially the same phase, at widely separated places, was held to indicate that their occurrence was not an artificiality due to changing exposure or other varying conditions of observation.

In the course of the discussion on the third paper, Dr. Brooks pointed out that the apparent variation in the lengths of his periods could not be explained as an effect of interference by a period of length 500 years. No explanation of the variation could be suggested.

Correspondence

To the Editor, *The Meteorological Magazine*

A Brilliant Parhelion of 120°

The recently published *Transactions of the Devonshire Association for the Advancement of Science* for 1927 contains a description, copied from the *Western Morning News*, July 23rd, 1925, of an interesting optical phenomenon. The observer, whose name is not given, says that on Tuesday, July 21st, about 9 p.m. he took up a position near the pier at Exmouth. The sky was overcast. He continues:—" My eyes wandered along the horizon, and just off Berry Head I noticed a faint suggestion of colour. First impressions were that of a portion of a rainbow, but closer observation revealed only a single colour, and that a pale red or pink. So far there was nothing to excite, but when the colour became brighter and assumed a definite shape, I realized it was something unusual, and my curiosity grew. It stood out in relief like a huge elongated toy balloon standing on end, and remained visible only a few minutes."

The phenomenon was called a sun-dog by the local fishermen, and was followed after an hour by rain.

The bearing of Berry Head from Exmouth is a little west of south, so the " sun-dog " may well have been 120° from the sun. The parhelion of 120° shows no rainbow colours, the pale red observed in this case was no doubt due to atmospheric absorption.

F. J. W. WHIPPLE.

Kew Observatory, Richmond, Surrey, January 14th, 1928.

Unusual Thunderstorm Phenomena

On a number of occasions I have noticed a sharp "vit" or "click" to accompany lightning that has struck something in the immediate neighbourhood and to precede the thunder by a perceptible fraction of a second. I have known this to occur both in cases where trees or wires have been struck. Will you be good enough to let me know the explanation why the sound of the contact should reach the ear before the thunder?

I have three times noticed animals to show alarm immediately before a flash. In one case, a dog, walking on grass, turned rapidly and began to bark angrily in the direction of a very strong flash that came $\frac{1}{4}$ of a second after, striking several of a group of trees 200 yards away. On the two other occasions bantam fowls started to rush for shelter from the open in alarm before a very near discharge actually took place. In each case the discharge was a very powerful one, taking place on dry soil before rain had fallen. May I take it that the sensitive feet of the dog and fowls were able to detect vibrations before the discharge had actually determined what course to take?

It may be of interest that I recently, without question, timed thunder to reach me 200 seconds after flashes from a distant storm. The storm was due west of this place, very low on the horizon, about on the coast line and the wind here was very light from the east. The volume of sound, having come so far, was quite sufficient to carry several miles further. I might add that it is not rare for thunder to be heard 180 seconds after the lightning during the distant February and March storms. Have you other instances of thunder travelling so far?

R. S. Breton.

Siam Commercial Bank, Tung Song, S. Siam.

[Mr. Breton's account of the "vit" or "click" accompanying lightning which has struck close by appears to be new; no reference to any similar observation can be found in the literature, and at present it is not possible to offer any explanation.

Many observers have reported cases in which they consider that they have detected the effect of thunderstorms on the behaviour of animals, but such observations are difficult to make with certainty. In the present state of our knowledge it is best to maintain an open mind on the reality of such phenomena and to offer no suggestions as to their cause if they should prove to be real.

Thunder is rarely heard more than 75 seconds after the lightning but very long intervals between lightning flashes and the corresponding thunder are occasionally noted. Veneema (*Das Wetter*, 1917, p. 192) quotes observations of 255 and 310 seconds on September 5th, 1899, at Nordeney and later (p. 261) he describes an instance in which he heard soft thunder from a storm on the horizon, at a distance subsequently estimated as

200 km.; this would correspond with an interval of about 600 seconds! These observations, however, are wholly exceptional, and are not entirely free from the suspicion that the " thunder " was simulated by some other noise, such as the rumble of a distant train. Veneema remarks that only the thunder associated with downward striking flashes is ever audible at great distances; also that the wind direction—at least up to the level of the clouds—makes very little difference, and that all irregularities of the earth's surface diminish the audibility.—Ed., *M.M.*]

The May Cold Spell

The whole difficulty in connexion with this subject (discussed in the last number by Mr. Powers) has always seemed to me to lie in a wrong interpretation of the facts. Now it is obvious that if a period be taken as long as three weeks centred upon May 12th, there will inevitably occur in most years something of a cold spell within that period, as in any other three weeks throughout the year. After all, the temperature is constantly fluctuating on either side of the seasonal normal throughout the year; English weather is made up of such fluctuations. How does the temperature rise in any individual spring? Typically it does so not steadily, but in a series of major and minor perturbations or jerks, and every deviation above or below the value which over a long period of years comes out as the seasonal normal is simply a " normal abnormality." And summer passes through autumn into winter in exactly the same way except that the changes from day to day are rather less sudden, as a rule, than in spring. Why, therefore, should a cold spell occurring in May be regarded in any other light than an ordinary fluctuation below the seasonal normal. If, as Mr. Powers shows, there is no real statistical evidence for a special tendency to a set back in temperature about May 12th in London, I am really very glad, for as a result of the most careful watching of the weather from year to year I have never taken this or any other of Buchan's cold or warm periods seriously. Experience has led me to feel as ready to put my money on a hot spell at the close of May, or a cold spell in the middle of June, as on a cold spell in the second week of May.

L. C. W. Bonacina.

27, *Tanza Road, Hampstead, N.W. May 22nd*, 1928.

Surface Wind and Day Horizontal Visibility

An examination has been undertaken of the Cranwell, Lincolnshire, observations during the period April 1st, 1920, to December 31st, 1927, in order to express the relationships existing between the ground horizontal day visibility on the one

hand and the direction and velocity of the surface wind taken at the same hours on the other. The observations utilised are those taken from 9h. to 17h. G.M.T. (both inclusive).

All the wind readings employed are those taken by a pressure-tube anemometer whose head is 43 feet above ground level, the ground itself being approximately 240 feet above sea level. No observations were available from 14h. to 17h. on Sunday or Bank Holiday afternoons, whilst others had to be neglected owing to missing or faulty anemometer readings either for direction or velocity alone or for both.

The distribution of visibility with regard to wind direction is shown in the first of the two following tables, and with regard to wind velocity in the second.

WIND DIRECTION	Total No. of Observations	Percentage of such observations when visability was—		
		13 miles or more	2¼ miles or more but not reaching 13 miles	Less than 2¼ miles
N/W - NNE	1849	29·7	60·9	9·4
NE/N - ENE	2152	36·9	55·7	7·4
E/N - ESE	1911	26·4	57·9	15·7
SE/E - SSE	1996	15·1	58·8	26·1
S/E - SSW	2980	39·0	53·9	7·1
SW/S - WSW	5559	30·4	63·1	6·5
W/S - WNW	4277	24·0	65·2	10·8
NW/W - NNW	2689	19·9	67·5	12·6
CALM	448	16·5	55·8	27·7

WIND VELOCITY m.p.h.	Total No. of Observations	Percentage of such observations when visability was—		
		13 miles or more	2¼ miles or more but not reaching 13 miles	Less than 2¼ miles
0 - 5	4098	17·3	59·5	23·2
6 - 10	5626	18·5	64·6	16·9
11 - 15	6691	27·4	65·2	7·4
16 - 20	4771	36·8	60·4	2·8
over 20	2561	49·1	49·6	1·3

The outstanding results that become evident from a consideration of the tables are :—

(*a*) that the visibility shows a progressive improvement with increase of wind velocity.

(*b*) that winds in the groups SE/E to SSE and Calm give easily the highest percentages of bad visibilities and the lowest percentages of good visibilities.

(*c*) that winds in the groups S'E-SSW and NE'N-ENE give the highest percentages of good visibilities.

(*d*) that winds in the groups SW'S-WSW, S'E-SSW, and NE'N-ENE give the lowest percentages of bad visibilities.

WILLIAM H. PICK.

R.A.F. Cadet College, Cranwell, Lincolnshire. February 15th, 1928.

NOTES AND QUERIES

Upper Air Observations in the Azores

The Upper Air Supplement to the *Daily Weather Report* of May 10th includes a pilot balloon report from the Azores for the first time. Both nephoscope observations on clouds and pilot balloon observations are now being received in London with the regular cabled reports from Horta. They are published in the Upper Air Supplement and also issued on the British wireless synoptic messages.

Major Agostinho, who succeeded the late Colonel Chaves as Director of the Meteorological Service of the Azores in 1926, is to be congratulated on his enterprise in inaugurating regular upper air observations in a region which is of peculiar importance for the study of world weather.

Cirrus at Low Levels

Previous letters on this subject appeared in the *Meteorological Magazine* for July, October, November and December, 1920. Clouds which one would class as cirrus were it not for the fact that they are obviously below 10,000 feet seem to be rather frequent in Egypt. They were observed frequently at the end of January, 1928, and Captain Woolley-Dod, Imperial Airways, informs me that he has frequently seen on the route Cairo-Basrah clouds which he would have classed as cirrus, but which were not more than 7,000 or 8,000 feet high. One point not mentioned by other observers is that such clouds do not appear to move with the velocity of the air.

For example, on January 31st, 1928, alto-cumulus at 11,500 feet was observed moving from 270° with a relative velocity of 14.3 radians per hour, which implies a velocity of about 30 m.p.h., a result in good agreement with pilot balloon observations. But the cirrus which in this case obscured the alto-cumulus had a relative velocity of 23.4 radians per hour, which does not agree with the wind velocity at such a level. There was evidence of a wave motion in the cirrus bands.

Again on January 25th, 1928, cirrus, obviously very low, was observed moving from west with a relative velocity of 32 radians per hour, but the winds up to 6,000 feet were NNE 15 m.p.h. and N by W 15 m.p.h. from 6,000 to 11,000 feet, so

that in this case neither the direction of the movement nor the speed agreed with any measured wind velocity or direction. In both cases we seem to be measuring the rate of progress in the wave motion responsible for the cloud formation and not the speed of the wind which is carrying the cloud along.

J. DURWARD.

"Pearl Necklace" Lightning

Miss C. M. Botley of 17, Holmesdale Road, Hastings, informs us that on May 4th at the height of a severe thunderstorm a bright white single flash in a southerly direction was noted at Hastings at 21h. 55m. This passed into, or was succeeded by, a number of luminous points of a golden colour lying along its path like the trail of a rocket. Though it was raining heavily at the time there was no question of reflection from drops as the trail followed the flash. The storm began at 21h. 30m., lasted three-quarters of an hour, and was followed by slight flooding in low-lying parts of Hastings.

Fifty Years' Observations at Belper, Derbyshire

Observations of temperature and rainfall have been made at Belper, 8 miles to the north of Derby, since November, 1876, by Mr. John Hunter and his sister, Miss Margaret J. Hunter. Summaries of these observations were published by the Royal Meteorological Society in the *Meteorological Record* from 1881-1911 and have subsequently appeared in the *Monthly Weather Report* of the Meteorological Office. The rainfall data have been published also in the annual volumes of *British Rainfall* since 1877.

The Meteorological Office has received recently from Mr. J. Hunter a monograph entitled *Summary of observations of Rainfall and Temperature during the* 50 *years* 1877 *to* 1926. The monograph contains some general remarks on the observations and tables which include serial monthly and annual values and normal values for 50 years of temperature (maximum, minimum and 9h. dry bulb temperatures and depression of wet bulb at 9h.) and rainfall (amount and number of days) together with absolute extremes of temperature and maximum rainfall in 24 hours for each month and year during the period 1877-1926. The tables include also monthly and annual values of the temperature of the River Derwent during the period 1877 to 1926 except for a break extending from October, 1885, to November, 1889.

The site of the rain-gauge has been changed twice during the 50 years and since 1899 the measurements have been made at

Quarry Bank. The author states, however, that the effects on the continuity of the rainfall record of the changes in elevations and exposure were relatively slight. Two graphs show the secular variation of rainfall (expressed as a percentage of the normal) and temperature at Belper while a third graph shows the rainfall for each of the fifty years arranged in ascending order of amount, from the driest, 1887, " Jubilee Year," with a fall of 20.23 in., to the wettest, 1882, with a fall of 42.90 in., together with the corresponding number of " rain-days " (days of measurable precipitation) and " wet days " (days with .04 in. or more). An interesting result which this last graph establishes is that the variation in the number of " rain-days " or " wet days " is much less than the variation in the rainfall amounts for the corresponding year.

Mr. J. Hunter's monograph forms a valuable contribution to our knowledge of the climate of Belper.

P. I. MULHOLLAND.

Meteorological Instruments

Messrs. C. F. Casella and Co.'s new catalogue (No. 548) is a very comprehensive and attractive publication. The instruments listed cover the whole range of meteorological requirements at an up-to-date station, including equipment for pilot-balloon and sounding-balloon work. A striking feature of the catalogue is the number of new instruments designed recently in the Meteorological Office. We see, for instance, on p. 7 the portable receiver for use with the electric cup anemometer,* on p. 12 the new shielded form of Dines anemometer head, on p. 18 the official pattern of anemometer mast, on p. 50 the protected form of thermometer now adopted for use at sea, and on p. 74 the taper-pattern rain measure.† The firm is to be commended for its enterprise in offering to the public instruments of similar type to those used at official stations, though the source of the design might perhaps have been more clearly acknowledged in some cases.

The text of the catalogue is written in a clear and readable form and much useful information is incorporated. The illustrations are excellent.

Reviews

The Present Status of Radio Atmospheric Disturbances. By L. W. Austin. (From the Smithsonian Report for 1926, pp. 203-8.) Pub. 2885, Washington, D.C., U.S.A., 1927.

This paper summarises very briefly the views of a number of writers on the subject of atmospherics, and indicates that at

* *London, Meteor. Mag.* **61**, 1926, p. 14.
† *London, Meteor. Mag.* **59**, 1924, p. 193.

present there is a considerable divergence of opinion as to the sources of the disturbances.

It is known that many atmospherics originate in thunderstorms, though according to the writer it is not certain that the lightning flashes are themselves always the actual sources. Cold fronts, particularly when they approach mountainous regions, produce atmospherics. There still remain, however, a number of problems to be solved, particularly as to the physical differences between crashes, grinders, etc., and the origin of individual atmospherics of different types.

D. BRUNT.

Meteorology. By David Brunt, M.A., B.Sc. The World's Manuals. Size $7\frac{1}{4} \times 5$ in., pp. 111, *Illus.* Published by Humphrey Milford at the Oxford University Press, London, 1928. Price, 2s. 6d. net.

The contents of this excellent little book may be conveniently indicated by the titles of the chapters which follow the interesting historical introduction :—The Atmosphere : its Constitution and some of its Physical Properties; The Standard Meteorological Observations and their Use ; The General Circulation of the Atmosphere ; Solar Radiation and its Reception in the Atmosphere ; The Variation of Temperature in the Atmosphere and some of its Physical Effects ; The Weather Map ; Theories of the Origin of Cyclonic Depressions ; Other Travelling Disturbances in the Atmosphere ; Thunderstorms ; Some further Notes on the Circulation of the Atmosphere. It is something of an achievement to have covered this wide field in little more than one hundred pages. The style is clear and the treatment lucid and interesting. The Press, too, has done its work well and has produced a volume attractive in type and set-out, on good paper and in a pleasant binding. Probably even the professional meteorologist will find advantage in this wide and rapid survey of his subject, while for the amateur it forms a valuable and interesting introduction. In such a book the specialist may find details with which he does not wholly agree, but in a brief treatment it is sufficient to give the generally accepted view without undue dogmatism on controversial matters, and on the whole the book conforms well to this policy.

It will be seen that it deals chiefly with the physical principles underlying weather phenomena, and possibly the title "Weather" would better indicate its character than the wider title chosen. Some of its readers may be unaware of the wider extensions of meteorology such as atmospheric optics, auroræ, atmospheric tides, and the phenomena of the upper atmosphere associated with the earth's magnetism, radio and sound transmission, meteors, ozone, and so forth ; as far as this book is concerned they will be left in substantial ignorance even as to

the existence of these problems. It seems a pity that some brief reference is not made to them, with indications as to where further information can be found.

To the reviewer it appears a duty on the author's part to guide interested readers to further sources of knowledge on the topics with which he deals; the bibliographical references actually given are very meagre, and the prices of the few books quoted are not stated. It would not have been difficult to indicate a suitable selection of the not very numerous good modern books on meteorology; also reference might usefully have been made to the *Meteorological Magazine* and some particulars given of the Royal Meteorological Society. Of course the almost sufficient answer to these remarks is the limited size of the book, and the undoubted fact that the subjects dealt with are the most central, important, and generally interesting parts of meteorology. Certainly it would be difficult to compress what has been given so as to afford more than five or six pages for these desiderata.

If the book runs to further editions, as is to be expected, references to the figures should be supplemented by an indication of the page on the book where they are to be found; at present it is necessary to turn to the index of illustrations first in order to find the diagrams referred to.

S. Chapman.

Obituaries

Mr. J. A. Curtis.—All friends of the Office will have heard with regret of the death of Mr. J. A. Curtis, which took place at his home in Fulham on Thursday, May 31st. Mr. Curtis underwent a serious operation about twelve months ago, from the effects of which he never fully recovered. He was born in 1849 at St. Budeaux, on the borders of Devon and Cornwall, but his parents migrated to London when he was only four years old, so that we may almost claim him as a Londoner. He joined the Office staff in 1869 at the age of twenty, and did not finally retire until November, 1920, so that his active work for the Office extended over more than fifty years. When I first knew the Office Mr. Curtis was in charge of what we now call the climatology division, and his elder brother Richard looked after the so-called observatory branch. In addition to the *Weekly* and *Monthly Weather Report*, the division was then responsible for the annual volume of *Returns from Stations of the Second Order*, a publication of daily observations and monthly summaries, which was finally discontinued in 1907. In those days a far greater proportion than at present of the data used in compiling the official publications was derived from stations maintained by private observers. The fostering of the love of meteorological observation among these enthusiastic amateurs

was thus an important part of the work of the head of the climatological division, but it was an aspect of it which made a strong appeal to one of Mr. Curtis's temperament. Perhaps my most vivid recollection of Curtis in those days was to see him seated at his desk near the window in the low-ceilinged room of the first floor at 63, Victoria Street, in which the statistical branch was housed, surrounded by half-a-dozen members of the Press and supplying to them the latest reports received and comparing them with the statistics for earlier years, or discussing the forecasts prepared by the forecast division which lived on the floors above. Such interruptions to the routine of a day's work, especially on the eve of a holiday, generally resulted in Mr. Curtis being kept at the Office long after 5 p.m., but that aspect of the matter never seemed to trouble him.

A few years later, in 1906, on the retirement of Mr. James Harding, Mr. Curtis became Chief Clerk and Cashier, a position which he continued to hold until his own retirement in the spring of 1914. That retirement was not to last long, for in the following year, knowing that the Office was hard pressed to carry on its work owing to the absence of so many members of the staff on war service and the transfer of others to war work in the Office, he volunteered his services for part-time work. The offer was gladly accepted, but part-time work soon became almost whole-time work, and it was not long before Mr. Curtis was reinstated in the position of Cashier. It was not until November, 1920, some six months after the transfer of the Office to the Air Ministry, that it was found practicable to release him from his responsibilities. Thus ended 51 years of service in the Office, but his friends have often had the pleasure of meeting him at the annual soirées.

Outside the Office Mr. Curtis's activities were many. Religion was to him a very vital thing, and he took a very active part in religious work. For 35 years he was Sunday School Superintendent of the Onslow Baptist Chapel, and for ten years he served it as deacon and Church Secretary. In later years he was associated with the Fulham Baptist Church, where he again served as deacon. Many were the positions of trust which Mr. Curtis held: President of the London Baptist Association, Treasurer of the United Kingdom Alliance, Treasurer of the Fulham Free Church Council, Treasurer of the London Sunday School Choir. Municipal work also claimed his attention. Though not a member of the Council, he was invited to stand for the Mayoralty and was duly elected Mayor of Fulham in 1903, a post which he filled with quiet distinction. Among Mr. Curtis's cherished possessions was an illuminated address presented to him by Councillors of all political parties, placing on record their high appreciation of the services which he (and be it said also Mrs. Curtis) had rendered to the Borough during his term

of Office. In 1914, on his retirement from the Office, he was appointed a Justice of the Peace, thus adding one more to the many channels through which his activities found their outlet. Mr. Curtis was married in 1875, and during the whole of his married life he lived in Fulham in the house in which he died. The sympathy of all his meteorological friends will go out to Mrs. Curtis and the members of her family in their loss.

R. G. K. Lempfert.

Mr. W. E. Plummer.—We regret to learn of the death, on May 22nd, at the age of 79, of Mr. W. E. Plummer, Director of the Liverpool Observatory, Bidston, one of the telegraphic reporting stations of the Meteorological Office. Mr. Plummer had been Director of this Observatory since 1892; previous to this he had held appointments at the Royal Observatory, Greenwich, at Mr. George Bishop's private observatory at Twickenham, and at the University Observatory at Oxford, where he assisted in many astronomical researches. He was much interested in the study of comets and contributed papers to the *Monthly Notices* of the Royal Astronomical Society on cometary observations.

Prof. Otto Nordenskjöld.—We regret to record the death on June 2nd at the age of 58 of Prof. Otto Nordenskjöld. Primarily a geologist, Prof. Nordenskjöld inherited an interest in polar exploration—he was the nephew of Baron A. E. Nordenskjöld who, in the *Vega*, first completed the north-east passage from Norway across the Arctic Ocean and through the Bering Straits—and in 1899 he put forward plans for a Swedish Antarctic expedition. This expedition under his leadership sailed from Sweden in October, 1901, on board the *Antarctic*, and landed on Seymour Island off the east coast of Graham land in February, 1902. Here winter quarters were established, but owing to the severe ice conditions of the summer of 1902-1903 the *Antarctic* was crushed and sunk in an attempt to relieve the party, and it was not until November, 1903, that both the winter party and the shipwrecked crew were rescued by a ship from the Argentine. Nordenskjöld became Professor of Geography at Gothenburg University and spent several years in preparing the scientific results of the expedition. His popular account was translated into English and published under the title *Antarctica*.

The Weather of May, 1928

The weather was generally fine, warm and sunny at the beginning and end of the month, but during the middle period it was mainly overcast and cool. Easterly winds prevailed for the first few days and the temperature exceeded 70° F. in most

parts on each of the four days, 3rd to 6th, rising to 74° F. at Tottenham on the 3rd and at Brighton and Southampton on the 4th. During this period much bright sunshine was experienced, over 13 hours being reported from several stations, while Deerness had 15·0 hrs. and Lerwick 14·5 hrs. on the 3rd and Portsmouth and Calshot 13·9 hrs. on the 6th. Thunderstorms occurred at many places in the south on the 3rd and 4th, and these were in a few cases associated with heavy rain; 0·91 in. fell at Cullompton on the 4th and 0·81 in. at Appledore, Kent, on the 3rd. Subsequently pressure became high over the North Atlantic and northerly winds prevailed generally with a low temperature until about the 23rd. The lowest minimum readings were, in the screen, 26° F. at Ford on the 9th and at Marlborough on the 10th, and on the ground 19° F. at Marlborough and Rhayader on the 10th. On the 15th-21st a depression moving south across the North Sea caused rain in most districts, among the largest amounts being 1·21 in. at Lyminge on the 21st, 1·20 in. at Emsworth on the 17th and 0·81 in. at Bradford on the 19th. Thunderstorms occurred locally from the 18th to 21st. From the 23rd a depression developed off south-west Ireland and there was a gradual change to southerly winds. Quiet, fine, warm weather prevailed generally over the greater part of England, but rain fell at times in Scotland and Ireland. The highest temperatures reached were 81° F. at Camden Square and 80° F. at Greenwich on the 28th and 80° F. at Southampton on the 29th, while over 13 hrs. bright sunshine occurred at many places on each of these days. Stornoway had as much as 15·4 hrs. on the 31st and Valentia 15·1 hrs. on the 29th. By the 31st the winds had shifted to east and the temperature had dropped considerably. The total sunshine for the month was below normal in most places, the total of 124 hrs. at Aberdeen being 63 hrs. below normal and that of 165 hrs. at Kew being 36 hrs. below normal, while deficits of 36 hrs. were recorded at Liverpool, 19 hrs. at Falmouth, 14 hrs. at Dublin and 4 hrs. at Stornoway. On the other hand Valentia and Birr Castle received respectively 13 hrs. and 11 hrs. more than the normal duration. The total rainfall for the month was very small in many parts, the percentage of the normal being only 20 at Cardiff. At Sway, Hants, there were 22 consecutive rainless days from April 22nd to May 13, and at Abergorloch (Carmarthen) 21 rainless days from April 24th to May 14th.

Pressure was above normal in a belt stretching from Spitsbergen and northern Scandinavia across Iceland and the western British Isles to Newfoundland and Bermuda, the greatest excess being 6·8 mb. at Seydisfjord and Isafjord. Pressure was below normal elsewhere in western and central Europe and at the Azores, the greatest deficits being 4·1 mb. at Horta and 3.9

Rainfall: May, 1928: England and Wales

Co.	Station	In.	Per-cent. of Av.	Co.	Station	In.	Per-cent. of Av.
Lond .	Camden Square	1·81	103	*Leics* .	Thornton Reservoir	1·28	64
Sur .	Reigate, The Knowle	2·02	119	,, .	Belvoir Castle	1·79	85
Kent .	Tenterden, Ashenden	3·09	197	*Rut* .	Ridlington	1·84	...
,, .	Folkestone, Boro. San.	2·93	...	*Linc* .	Boston, Skirbeck	1·70	97
,, .	Margate, Cliftonville	2·37	150	,, .	Lincoln, Sessions House	1·29	69
,, .	Sevenoaks, Speldhurst	2·34	...	,, .	Skegness, Marine Gdns	1·76	104
Sus .	Patching Farm	1·01	54	,, .	Louth, Westgate	1·35	67
,, .	Brighton, Old Steyne	1·55	96	,, .	Brigg, Wrawby St.	1·32	...
,, .	Tottingworth Park	1·79	99	*Notts* .	Worksop, Hodsock	1·66	83
Hants .	Ventnor, Roy. Nat. Hos.	2·03	119	*Derby* .	Derby	·87	46
,, .	Fordingbridge, Oaklnds	1·47	71	,, .	Buxton, Devon Hos.	·70	23
,, .	Ovington Rectory	1·43	66	*Ches* .	Runcorn, Western Pt.	1·29	56
,, .	Sherborne St. John	1·94	100	,, .	Nantwich, Dorfold Hall	·94	...
Berks .	Wellington College	1·66	89	*Lancs* .	Manchester, Whit. Pk.	1·20	57
,, .	Newbury, Greenham	1·33	71	,, .	Stonyhurst College	·91	32
Herts .	Benington House	1·62	86	,, .	Southport, Hesketh Pk	1·45	69
Bucks .	High Wycombe	1·51	86	,, .	Lancaster, Strathspey	·86	...
Oxf .	Oxford, Mag. College	·65	37	*Yorks* .	Wath-upon-Dearne	1·99	98
Nor .	Pitsford, Sedgebrook	1·05	55	,, .	Bradford, Lister Pk.	1·91	91
,, .	Oundle	2·06	...	,, .	Oughtershaw Hall	1·72	...
Beds .	Woburn, Crawley Mill	1·43	74	,, .	Wetherby, Ribston H.	2·34	113
Cam .	Cambridge, Bot. Gdns.	2·60	148	,, .	Hull, Pearson Park	1·16	60
Essex .	Chelmsford, County Lab	1·85	129	,, .	Holme-on-Spalding	·98	...
,, .	Lexden, Hill House	1·88	...	,, .	West Witton, Ivy Ho.	2·35	...
Suff .	Hawkedon Rectory	1·94	105	,, .	Felixkirk, Mt. St. John	1·46	78
,, .	Haughley House	1·75	...	,, .	Pickering, Hungate	1·34	...
Norf .	Beccles, Geldeston	2·01	113	,, .	Scarborough	1·29	68
,, .	Norwich, Eaton	1·97	102	,, .	Middlesbrough	1·19	62
,, .	Blakeney	1·58	100	,, .	Baldersdale, Hury Res.	1·77	...
,, .	Little Dunham	2·37	122	*Durh* .	Ushaw College	1·51	71
Wilts .	Devizes, Highclere	1·14	63	*Nor* .	Newcastle, Town Moor	1·31	65
,, .	Bishops Cannings	1·13	58	,, .	Bellingham, Highgreen	1·32	...
Dor .	Evershot, Melbury Ho.	1·70	83	,, .	Lilburn Tower Gdns.	1·42	...
,, .	Creech Grange	1·12	...	*Cumb* .	Geltsdale	1·56	...
,, .	Shaftesbury, Abbey Ho.	1·77	84	,, .	Carlisle, Scaleby Hall	1·23	51
Devon .	Plymouth, The Hoe	1·42	69	,, .	Borrowdale, Rosthwaite	1·01	...
,, .	Polapit Tamar	1·28	63	,, .	Keswick, High Hill	2·08	...
,, .	Ashburton, Druid Ho.	1·11	41	*Glam* .	Cardiff, Ely P. Stn.	·50	20
,, .	Cullompton	1·87	87	,, .	Treherbert, Tynywaun	·67	...
,, .	Sidmouth, Sidmount	1·32	67	*Carm* .	Carmarthen Friary	·92	33
,, .	Filleigh, Castle Hill	1·08	..	,, .	Llanwrda, Dolaucothy	1·10	33
,, .	Barnstaple N. Dev. Ath.	·85	41	*Pemb* .	Haverfordwest, School	·95	38
Corn .	Redruth, Trewirgie	...	...	*Card* .	Aberystwyth	·67	...
,, .	Penzance, Morrab Gdn.	1·16	52	,, .	Cardigan, County Sch.	·72	...
,, .	St. Austell, Trevarna	1·69	70	*Brec* .	Crickhowell, Talymaes	1·80	...
Soms .	Chewton Mendip	1·19	43	*Rad* .	Birm W. W. Tyrmynydd	1·13	33
,, .	Long Ashton	1·11	...	*Mont* .	Lake Vyrnwy	1·49	47
,, .	Street, Hind Hayes	...	...	*Denb* .	Llangynhafal	2·78	...
Glos .	Cirencester, Gwynfa	1·11	54	*Mer* .	Dolgelly, Bryntirion	1·18	36
Here .	Ross, Birchlea	·86	40	*Carn* .	Llandudno	·95	50
,, .	Ledbury, Underdown	·92	45	,, .	Snowdon, L. Llydaw 9	3·23	...
Salop .	Church Stretton	1·43	55	*Ang* .	Holyhead, Salt Island	1·28	65
,, .	Shifnal, Hatton Grange	·76	37	,, .	Lligwy	1·06	...
Worc .	Ombersley, Holt Lock	1·08	53	*Isle of Man*			
,, .	Blockley, Upton Wold	1·09	51		Douglas, Boro' Cem.	1·33	53
War .	Farnborough	·74	33	*Guernsey*			
,, .	Birminghm, Edgbaston	·46	21		St. Peter P't. Grange Rd.	3·00	176

Rainfall: May, 1928: Scotland and Ireland

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent. of Av.
Wigt .	Stoneykirk, Ardwell Ho	1·44	57	*Suth* .	Loch More, Achfary ...	3·66	83
,, .	Pt. William, Monreith	2·28	...	*Caith* .	Wick	...	...
Kirk .	Carsphairn, Shiel.	1·61	...	*Ork* .	Pomona, Deerness	1·51	76
,, .	Dumfries, Cargen	2·10	70	*Shet* .	Lerwick	1·22	58
Dumf.	Eskdalemuir Obs.	1·54	47	*Cork* .	Caheragh Rectory	2·33	...
Roxb .	Branxholm	...	...	,, .	Dunmanway Rectory...	2·31	68
Selk .	Ettrick Manse	1·99	..	,, .	Ballinacurra	2·45	103
Peeb .	West Linton	1·70	...	,, .	Glanmire, Lota Lo. ...	2·50	102
Berk .	Marchmont House......	1·13	46	*Kerry*.	Valentia Obsy.	2·42	77
Hadd.	North Berwick Res. ...	1·30	65	,, .	Gearahameen	2·70	...
Midl .	Edinburgh, Roy. Obs.	1·43	77	,, .	Killarney Asylum	1·31	43
Ayr .	Kilmarnock, Agric. C.	1·79	78	,, .	Darrynane Abbey	2·13	71
,, .	Girvan, Pinmore	1·28	43	*Wat* .	Waterford, Brook Lo...	1·99	86
Renf .	Glasgow, Queen's Pk. .	2·00	82	*Tip* .	Nenagh, Cas. Lough...	1·47	60
,, .	Greenock, Prospect H.	1·97	57	,, .	Roscrea, Timoney Park	1·45	...
Bute .	Rothesay, Ardencraig .	2·35	78	,, .	Cashel, Ballinamona...	1·67	70
,, .	Dougarie Lodge	1·72	...	*Lim* .	Foynes, Coolnanes......	·98	42
Arg .	Ardgour House	1·45	...	,, .	Castleconnel Rec.	1·65	...
,, .	Manse of Glenorchy ...	1·40	...	*Clare* .	Inagh, Mount Callan...	1·51	...
,, .	Oban	·94	...	,, .	Broadford, Hurdlest'n.	1·39	...
,, .	Poltalloch	1·29	45	*Wexf* .	Newtownbarry	1·44	...
,, .	Inveraray Castle...	1·29	33	,, .	Gorey, Courtown Ho ..	1·15	52
,, .	Islay, Eallabus	1·27	48	*Kilk* .	Kilkenny Castle.........	1·51	68
,, .	Mull, Benmore	3·20	...	*Wic* .	Rathnew, Clonmannon	1·10	...
,, .	Tiree	...	...	*Carl* .	Hacketstown Rectory..	1·36	52
Kinr .	Loch Leven Sluice......	1·62	66	*QCo* .	Blandsfort House	1·27	52
Perth .	Loch Dhu	2·05	46	,, .	Mountmellick............	1·58	...
,, .	Balquhidder, Stronvar	1·47	...	*KCo* .	Birr Castle	2·17	97
,, .	Crieff, Strathearn Hyd.	2·18	88	*Dubl* .	Dublin, FitzWm. Sq...	·82	40
,, .	Blair Castle Gardens ...	1·13	56	,, .	Balbriggan, Ardgillan.	1·13	54
Forf .	Kettins School	1·74	72	*Me'th* .	Beaupare, St. Cloud...	1·51	...
,, .	Dundee, E. Necropolis	1·36	65	,, .	Kells, Headfort	1·38	51
,, .	Pearsie House............	1·49	...	*W.M* .	Moate, Coolatore	1·74	...
,, .	Montrose, Sunnyside...	1·29	63	,, .	Mullingar, Belvedere..	1·90	78
Aber .	Braemar, Bank	...	...	*Long* .	Castle Forbes Gdns......	1·73	67
,, .	Logie Coldstone Sch....	1·39	56	*Gal* .	Ballynahinch Castle ...	1·69	47
,, .	Aberdeen, King's Coll.	1·60	69	,, .	Galway, Grammar Sch.	·72	...
,, .	Fyvie Castle	1·87	...	*Mayo* .	Mallaranny...............	1·24	...
Mor .	Gordon Castle	1·38	65	,, .	Westport House.........	·91	32
,, .	Grantown-on-Spey ...	2·55	109	,, .	Delphi Lodge	2·23	...
Na .	Nairn, Delnies	1·85	103	*Sligo* .	Markree Obsy............	1·32	47
Inv .	Ben Alder Lodge	...	...	*Cav'n* .	Belturbet, Cloverhill...	1·66	67
,, .	Kingussie, The Birches	1·73	...	*Ferm* .	Enniskillen, Portora...	1·58	...
,, .	Loch Quoich, Loan ...	1·40	...	*Arm* .	Armagh Obsy............	·80	34
,, .	Glenquoich..............	1·38	25	*Down* .	Fofanny Reservoir......	1·87	...
,, .	Inverness, Culduthel R.	2·06	...	,, .	Seaforde	1·24	47
,, .	Arisaig, Faire-na-Squir	...	...	,, .	Donaghadee, C. Stn ...	...	...
,, .	Fort William	·85	...	,, .	Banbridge, Milltown...	·97	43
,, .	Skye, Dunvegan	1·85	...	*Antr* .	Belfast, Cavehill Rd ...	1·69	...
R & C.	Alness, Ardross Cas. ...	3·17	122	,, .	Glenarm Castle	1·15	...
,, .	Ullapool	1·37	...	,, .	Ballymena, Harryville	1·38	48
,, .	Torridon, Bendamph...	2·41	53	*Lon* .	Londonderry, Creggan	1·13	43
,, .	Achnashellach	1·89	...	*Tyr* .	Donaghmore	1·38	...
,, .	Stornoway	...	...	,, .	Omagh, Edenfel.........	1·54	59
Suth .	Lairg	1·39	...	*Don* .	Malin Head...............	1·20	61
,, .	Tongue	1·86	78	,, .	Dunfanaghy	·92	...
,, .	Melvich	1·43	70	,, .	Killybegs, Rockmount.	2·26	63

Climatological Table for the British Empire, December, 1927.

STATIONS	PRESSURE		TEMPERATURE									PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values				Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Wet Bulb	Relative Humidity.	Mean Cloud Am'nt	Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	0—10	in.	in.			
London, Kew Obsy:	1012·6	− 1.1	54	21	39·9	33·6	36·7	− 3·6	34·8	86	8·1	3·70	+ 1·41	11	0·9	12
Gibraltar	1013·8	− 6·3	67	44	61·2	51·9	56·5	+ 0·5	51·8	83	7·1	14·39	+ 8·78	18	..	..
Malta	1011·5	− 5·1	69	48	63·3	56·1	59·7	+ 1·8	55·9	83	7·4	5·69	+ 1·98	16	4·7	49
St. Helena	1013·2	+ 2·5	69	57	66·6	57·6	62·1	− 0·1	58·5	93	9·0	1·50	− 0·46	13	..	..
Sierra Leone	1011·2	+ 0·3	91	70	88·8	74·9	81·9	+ 0·5	76·6	77	2·7	0·23	− 1·19	1	..	..
Lagos, Nigeria	1009·1	− 1·4	91	74	88·7	77·5	83·1	+ 1·6	77·9	84	6·8	1·17	+ 0·37	4	..	..
Kaduna, Nigeria	1015·6	+ 2·8	94	65	89·2	68·5	78·9	+ 5·6	69·6	84	1·0	0·00	0·00	0	..	..
Zomba, Nyasaland	1009·0	+ 0·7	94	55	82·4	63·8	73·1	0·0	..	97	7·5	11·80	+ 0·93	18	..	..
Salisbury, Rhodesia	1009·3	− 0·3	85	56	79·2	60·2	69·7	+ 0·1	..	71	6·8	4·72	− 1·06	17	6·2	47
Cape Town	1014·2	− 0·1	86	49	77·6	59·1	68·3	+ 0·4	62·3	72	4·1	1·28	+ 0·46	9	..	..
Johannesburg	1010·2	− 0·1	85	51	78·8	55·0	66·9	+ 1.8	58·4	67	5·7	3·83	− 1·60	11	8·8	64
Mauritius	1014·2	+ 0·2	92	67	84·6	71·8	78·2	− 0·1	73·4	69	6·9	6·35	+ 1·62	17	7·5	56
Bloemfontein	..	..	94	50	85·5	59·4	72·5	+ 0·7	60·9	57	3·2	1·70	− 0·75	6	..	..
Calcutta, Alipore Obsy.	1016·1	+ 0·4	82	51	79·2	57·8	68·5	+ 2·0	58·9	84	1·6	0·00	− 0·20	0*	..	..
Bombay	1013·1	− 0·4	87	64	84·0	71·3	77·7	+ 0·2	68·2	77	2·7	0·09	+ 0·04	1*	..	..
Madras	1014·2	+ 0·7	86	65	84·0	70·2	77·1	+ 0·4	71·7	83	3·7	2·33	− 3·48	7*	..	..
Colombo, Ceylon	1011·5	+ 0·8	90	69	88·0	72·7	80·3	+ 1·3	74·9	71	4·7	3·63	− 1·74	6	8·1	69
Hongkong	1018·5	− 1·2	80	49	70·2	61·9	66·1	+ 3·1	60·5	71	5·7	1·37	+ 0·24	3	5·7	53
Sandakan	..	..	90	73	88·0	74·8	81·4	+ 1·3	77·2	87	..	16·27	− 1·39	24	..	..
Sydney	1013·5	+ 1·6	92	56	75·1	62·7	68·9	− 1·2	64·2	67	6·6	2·35	− 0·56	9	6·1	42
Melbourne	1013·0	+ 0·5	102	49	78·3	57·6	67·9	+ 3·6	59·9	55	5·3	1·32	− 1·02	9	7·1	48
Adelaide	1013·2	0·0	103	51	82·9	60·2	71·5	+ 0·4	59·2	39	4·8	1·46	+ 0·46	8	10·4	72
Perth, W. Australia	1012·7	− 0·5	106	54	86·5	64·0	75·3	+ 4·6	63·5	45	3·1	0·19	− 0·39	5	10·3	73
Coolgardie	1012·4	+ 1·2	103	50	90·1	60·0	75·1	− 0·7	62·3	47	2·4	1·08	+ 0·38	2	..	..
Brisbane	1012·7	+ 0·7	91	62	80·6	65·8	73·2	− 3·2	67·8	66	6·9	5·58	+ 0·74	20	5·9	43
Hobart, Tasmania	1011·5	+ 1·8	92	43	70·3	52·7	61·5	+ 1·1	54·9	56	6·5	2·73	+ 0·77	14	7·4	49
Wellington, N.Z.	1015·0	+ 2·8	79	41	65·0	51·9	58·5	− 1·9	54·8	72	6·9	3·17	− 0·05	12	6·5	43
Suva, Fiji	1007·7	− 0·9	97	72	87·3	75·4	81·3	+ 2·4	77·3	81	6·0	17·39	+ 5·28	27	7·6	58
Apia, Samoa	1008·5	+ 0·1	89	73	85·0	75·7	80·3	+ 1·0	77·9	79	5·9	20·08	+ 6·46	24	5·4	42
Kingston, Jamaica	1014·2	+ 0·2	88	65	85·3	67·9	76·6	− 1·1	66·2	87	2·1	0·00	− 1·59	0	7·8	70
Grenada, W.I.	1008·0	− 3·5	87	71	84·4	74·5	79·5	+ 1·4	74·2	75	3·9	8·10	+ 0·83	17	..	..
Toronto	1017·2	− 0·2	54	8	35·0	23·4	29·2	+ 3·0	25·8	77	7·4	3.14	+ 0·31	14	2·1	23
Winnipeg	1022·6	+ 4·7	23	−28	3·9	−9·5	−2·8	− 8·5	..	..	2·6	0·66	− 0·32	5	3·8	46
St. John, N.B.	1012·6	− 1·6	55	4	35·2	21·4	28·3	+ 3·9	24·6	77	6·0	4·98	+ 0·81	18	2·5	28
Victoria, B.C.	1018·8	+ 2·0	54	16	40·6	33·3	36·9	− 4·6	34·9	84	7·2	3·11	− 2·80	15	2·6	31

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

Climatological Table for the British Empire, Year, 1927

STATIONS	Pressure: Mean of Day M.S.L. (mb.)	Pressure: Diff. from Normal (mb.)	Temperature: Absolute Max. (°F.)	Temperature: Absolute Min. (°F.)	Temperature: Mean Values Max. (°F.)	Temperature: Mean Values Min. (°F.)	Temperature: Mean Values ½ max. and min. (°F.)	Temperature: Mean Values Diff. from Normal (°F.)	Temperature: Mean Wet Bulb (°F.)	Relative Humidity (%)	Mean Cloud Am'nt (0–10)	Precipitation: Am'nt (in.)	Precipitation: Diff. from Normal (in.)	Precipitation: Days	Bright Sunshine: Hours per day	Bright Sunshine: Percentage of possible
London, Kew Obsy.	1013·4	− 2·0	80	21	56·0	43·8	49·9	+ 0·2	45·2	87	7·1	32·12	+ 8·32	163	3·6	30
Gibraltar	1017·5	− 0·4	94	42	70·9	57·7	64·3	0·0	56·9	81	5·0	36·07	+ 0·25	90	..	..
Malta	1015·8	− 0·1	98	45	71·4	62·3	66·9	+ 0·8	62·3	81	4·6	14·93	− 4·93	69	8·5	70
St. Helena	1013·7	+ 2·2	73	52	64·1	57·4	60·8	− 1·2	58·4	92	5·3	27·39	− 12·73	..	..	..
Sierra Leone	1012·1	+ 0·7	95	66	86·9	73·2	80·1	− 0·6	75·3	79	5·6	135·12	− 22·11	173	..	..
Lagos, Nigeria	1010·1	− 1·3	93	68	85·8	75·0	80·4	− 0·1	75·9	83	5·6	55·00	− 16·63	112	..	..
Kaduna, Nigeria	..	..	99	..	88·0	..	..	..	69·3	70	..	55·60	+ 6·37	118	..	..
Zomba, Nyasaland	1013·1	+ 0·8	94	..	79·0	..	..	..	..	80	5·9	50·48	− 3·12	121	..	..
Salisbury, Rhodesia	1013·4	− 0·3	91	32	76·8	52·7	64·8	− 0·5	..	60	3·8	24·59	− 7·35	79	8·2	68
Cape Town	1017·5	+ 0·5	101	38	73·5	54·9	64·2	+ 1·9	56·5	79	3·9	18·96	− 6·34	78	..	..
Johannesburg	1016·9	+ 0·7	93	27	71·5	49·6	60·5	+ 1·0	50·9	58	2·5	23·44	− 9·78	81	8·5	70
Mauritius	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bloemfontein	..	..	102	21	76·2	48·7	62·4	+ 1·0	51·1	61	3·0	14·65	− 8·72	48	..	..
Calcutta, Alipore Obsy.	1007·5	− 0·1	103	49	88·0	71·5	79·7	+ 1·0	72·2	85	4·7	45·82	− 16·72	69*	..	..
Bombay	1008·7	− 0·5	94	63	85·7	74·9	80·3	− 0·2	72·4	78	4·3	74·38	+ 2·19	88*	..	..
Madras	1008·6	− 0·2	109	62	92·0	75·9	83·9	+ 0·9	75·3	75	5·6	32·24	− 18·50	60*	..	..
Colombo, Ceylon	1010·0	0·0	91	67	87·0	75·0	81·0	+ 0·3	77·2	76	7·2	91·28	+ 6·03	182	6·6	55
Hongkong	1012·2	− 0·4	93	46	75·9	68·0	72·0	− 0·3	67·5	79	7·3	107·88	+ 24·06	158	5·0	41
Sandakan	..	..	92	73	88·1	75·4	81·7	+ 0·4	77·1	85	..	114·91	− 4·81	174	..	..
Sydney	1016·1	+ 0·2	101	39	70·1	55·1	62·6	− 0·6	56·8	69	5·1	48·56	+ 0·66	138	6·4	54
Melbourne	1016·7	+ 0·4	106	30	67·9	49·8	58·8	+ 0·4	52·4	65	5·9	17·98	− 7·57	135	5·8	46
Adelaide	1017·4	+ 0·4	110	36	73·1	53·0	63·0	0·0	53·7	51	5·3	16·92	− 4·28	101	7·3	60
Perth, W. Australia	1016·0	− 0·4	106	38	73·6	55·5	64·6	+ 0·4	57·7	63	5·1	36·59	+ 2·56	133	7·6	62
Coolgardie	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brisbane	1016·0	+ 0·2	93	39	77·2	59·1	68·1	− 0·8	61·6	67	4·7	62·09	+ 17·43	129	7·7	64
Hobart, Tasmania	1013·6	+ 1·0	102	32	61·5	46·4	53·9	− 0·4	47·9	64	6·5	20·13	− 3·61	185	6·0	50
Wellington, N.Z.	1014·2	− 0·5	84	31	61·7	49·1	55·4	+ 0·1	52·0	73	6·3	43·35	− 4·69	167	5·6	46
Suva, Fiji	1010·9	− 0·5	97	63	84·2	72·8	78·5	+ 1·5	74·3	82	6·9	149·17	+ 36·79	273	5·3	44
Apia, Samoa	1010·9	+ 0·6	89	71	84·9	75·1	80·0	+ 1·5	77·1	79	5·5	132·35	+ 25·50	223	6·8	56
Kingston, Jamaica	1013·7	0·0	93	62	87·2	70·8	79·0	− 0·3	69·7	85	3·7	25·73	− 7·86	67	8·7	72
Grenada, W.I.	1009·3	− 2·9	92	67	85·5	74·7	80·1	+ 1·3	75·4	77	5·0	76·76	+ 0·68	230	..	..
Toronto	1016·5	+ 0·1	95	− 17	54·8	38·7	46·8	+ 2·4	41·3	76	5·8	30·77	− 2·70	145	5·5	45
Winnipeg	1016·8	+ 0·6	90	− 32	44·6	27·5	36·0	+ 1·7	..	..	4·9	21·45	+ 0·38	112	5·4	44
St. John, N.B.	1014·3	− 0·4	79	− 9	49·0	35·4	42·2	+ 1·0	38·7	79	6·1	54·23	+ 6·15	154	..	..
Victoria, B.C.	1016·3	− 0·1	89	16	54·8	43·8	49·3	− 0·2	45·7	78	6·6	25·58	− 6·91	143	5·8	48

mb. at Copenhagen. Temperature was above normal over Spitsbergen and northern Scandinavia and below normal elsewhere, while rainfall was generally below normal except for Spitsbergen and parts of Sweden (southern Norrland and southern Gothland), central Europe and eastern England.

Floods due to the formations of ice dams on the Klaräloen and Dalälven rivers caused serious damage in Sweden early in the month. On the 1st a severe storm swept across Roumania and Bulgaria and 6 children were killed. Storms were also reported from Paris on the 5th and from Budapest on the 9th, and floods occurred in the valley of the Struma on the 4th, and in the Chamonix valley and the valley of the Bièvre about the 8th owing to the heavy rains. From about the 10th to 22nd cold weather prevailed generally in France, central Europe and northern Italy; snow occurred as far south as Perugia and Fabriano and the frost did much damage to the crops in all parts. On May 15th much of the crops in the fertile district of Ottaiano was destroyed by rain, which had been contaminated by falling through the vapours emitted by Vesuvius. Continuous heavy rain during Whitsuntide caused severe floods in part of lower and middle Silesia, and on the 31st thunderstorms caused serious damage to the crops in eastern Switzerland. Snow fell in large quantities in Tirol on the 28th, which is very unusual so late in the year.

Very hot weather was experienced in Lower Burma at the beginning of the month.

Owing to the warm weather in Ontario about the 8th the snow in the northern hinterland melted with unusual rapidity causing floods in the Ottawa valley and in northern Ontario. These continued until the 16th, when the situation began to improve. Temperature rose above 90° F. at many places in Saskatchewan and Manitoba on the 21st to 26th, reaching 98° F. at Battleford on the 21st and Medicine Hat on the 22nd. Heavy floods also occurred near Quebec about the 28th. Dense fog was prevalent over the western North Atlantic from about the 16th to 19th.

The special message from Brazil states that rain was very scarce in the north being 3.03 in. below normal, in the centre it was 1.30 in. below normal, and in the south the distribution was irregular, the average being 3.15 in. above normal. The circulation was active and seven anticyclones passed over the country; depressions over the southern part of the continent caused the temperature to fall in Argentina and southern Brazil. At Rio de Janeiro pressure was 0.2 mb. below normal and temperature 1.3° F. above normal.

Rainfall, May 1928—General Distribution

England and Wales ...	74	per cent. of the average 1881-1915.
Scotland	66	
Ireland	60	
British Isles	69	

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